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TUBERCULOSIS IN FOWLS.

By ARCHIBALD R. WARD.

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TUBERCULOSIS IN FOWLS.

By ARCHIBALD R. WARD.

Tuberculosis in fowls is a serious pest in Europe, but seems to be rare in America, or at least has not been frequently reported. Pernot* is apparently the first to mention its existence upon the Pacific Coast. He reports six outbreaks in Oregon and gives a description of the symptoms and post-mortem appearances.

Moore and the present writer studied tuberculosis of fowls in California during the summer of 1903. Papers† dealing with the pathological aspects of the disease have been published, and in consequence considerable material, of interest only to the professional man, has been omitted from the present publication. Observations during the past year have demonstrated that the disease is distributed broadly enough to demand the serious attention of poultrymen.

The disease exists extensively among many large poultry ranches, but seldom kills enough fowls at any one time to excite the alarm of the owner. Its existence in a flock constitutes a steady drain, but it fails to attract much attention, because the losses are so evenly distributed in point of time.

So far the writer has observed tuberculosis in grown fowls only. It does not appear to occur in young chicks.

In the first outbreak of the disease brought to notice, the owner reported a loss of about two hundred and fifty fowls during a year, out of a flock of fourteen hundred. He had made a large number of post-mortem examinations, and as the alterations occurring in the disease are readily recognized, the observations have some interest.

Symptoms.—There seems to be no noticeable symptom until the disease has progressed far enough to cause emaciation and weakness.

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*Pernot, E. F.: Investigations of Diseases of Poultry. Oregon Agricultural Experiment Station, Bulletin No. 64, 1900.

†Moore, V. A., and Ward, A. R.: Avian Tuberculosis. Transactions of the American Veterinary Medical Association, 1903, p. 169.

†Ward, A. R.: Tuberculosis in Fowls. California State Journal of Medicine, December, 1903.

†Moore, V. A.: The Morbid Anatomy and Etiology of Avian Tuberculosis. The Journal of Medical Research, Vol. XI, No. 2 (new series, Vol. VI, No. 2), pp. 521-536, May, 1904.

In such cases the breast muscles are found to be wasted away and the light weight is very noticeable.

Fig. 1 shows the breast bone of a tuberculous hen from which the skin only has been removed. It illustrates the extent to which the wasting may progress, for barely a trace of the breast muscles remains. Lameness often occurs, and poultrymen usually refer to such fowls as affected with "rheumatism." This conclusion is not justified, for in a number of such cases the writer has been able to find tuberculosis of the joints, which would account for the lameness. In the last stages of sickness, the affected bird crouches, apparently from weakness. The pale comb, ruffled feathers, unnatural gait, and general attitude are features that attract attention to the victims of the disease. A very small percentage of affected fowls show tuberculous nodules on the

Fig. 1. Breastbone of a fowl, showing excessive emaciation in tuberculosis.

skin of various portions of the body. These may consist of single spherical masses each surrounding the root of a feather, or more often consist of larger masses. Fig. 2 illustrates this form of the disease occurring upon the neck of a fowl. These nodules, when occurring upon the head, should not be confused with the swellings that appear on the head in advanced cases of roup (swell head), nor with the wart-like lumps found on the head in chicken-pox.

Facts concerning the length of time that fowls usually live when infected have not yet been secured. One hen, inoculated by injecting crushed tuberculous liver into the abdominal cavity, died in six weeks of generalized tuberculosis.

Lesions.—In most cases the liver is affected. It is found enlarged and studded throughout with yellowish-white nodules of a more or less cheesy consistency, varying greatly in size and number in different cases. The nodules are very readily separated from the surrounding

liver tissue. Poultrymen are familiar with the condition, and refer to it as "liver complaint" or as "spotted liver." Fig. 3 illustrates the condition described. The spleen, in health a small rounded purple organ about half an inch in diameter, is frequently affected with tuberculosis, and in consequence greatly enlarged. Rounded masses of varying size may be found in the walls of any part of the intestine. The mesentery, the thin membrane to the border of which the intestine is attached, is occasionally dotted with nodular masses. Fig. 4 illustrates the tubercular growths upon the mesentery. The lungs are very rarely affected. Alterations of the bones, joints, or other organs occur more rarely, and are not so readily recognized as the changes described. Most hens badly affected with tuberculosis are very lean, but exceptions have been observed.

FIG. 2. Tuberculosis of the skin of the neck of a fowl.

FIG. 3. Liver of a fowl affected with tuberculosis.

Spread of Tuberculosis among Fowls.—Tuberculosis is an infectious disease caused by organisms, known as tubercle bacteria, which gain entrance to certain organs of the body and multiply there. The nodular growths (tubercles) so constantly found in tuberculosis are caused by the presence of these bacteria in the affected regions. The spread of

tuberculosis from one fowl to another occurs only when conditions permit the transfer of the live tubercle bacteria more or less directly from the diseased to the healthy. The presence of tubercular growths in the walls of the intestine and in the liver suggests that the tubercle bacteria enter the body with the food. The rarity with which tuber-

FIG. 1. Intestines and mesentery of a fowl affected with tuberculosis.

culosis occurs in the lungs of fowls would indicate that infection by the inhalation of tubercle bacteria occurs rarely, if at all.

An examination of the tubercular growths located along the walls of the intestine leads to the conclusion that the tubercle bacteria are liberated from the body along with the droppings. In a large percentage of bad cases of tuberculosis, tubercles will be found to have a cavity in the center which communicates with the interior of the intestine. A microscopic examination of the contents of the intestine at

such points shows that enormous numbers of tubercle bacteria are present. The conclusion that they are liberated through the intestine is unavoidable. The droppings of fowls affected with tuberculosis must therefore be regarded as an important factor in the spread of the disease.

No evidence is at hand to indicate that tuberculosis is spread through the egg. Post-mortem examinations and observations upon living fowls lead to the conclusion that badly infected fowls, at least, do not lay. Considerable attention has been paid to the ailments causing the death of young chicks, but no tuberculosis has been discovered among them. The disease would be found in young stock if it were commonly transmitted to the young through the egg.

The location in which the droppings are deposited bears considerable relation to the probability of that material being a means of infecting healthy fowls. The practice of feeding soft food from the ground affords the best of opportunity for the contamination of the food with fresh droppings. Sunlight is rapidly fatal to tubercle bacteria, but it by no means has opportunity to freely act upon infectious material out of doors. Indoors, the tubercle bacteria may remain alive and dangerous for many weeks. The eating habits of fowls indicate that they are in danger of infection by way of the crop in the roosting-houses, although no food may be there. Furthermore, there always exists the possibility of conveying infectious material by the feet, to the food outside.

The Control of Tuberculosis in Fowls.—There is no known remedy for the cure of tuberculosis in the fowl. Affected birds should be killed as soon as the existence of the disease is recognized. It is useless to attempt treatment. It must be controlled by measures designed to keep the healthy fowls separated from the diseased ones. When the disease exists in a flock of fowls there are usually many in the early stages that do not betray their condition by appearance or behavior. This insidious mode of development is an important characteristic of tuberculosis and one that frequently blinds people to its seriousness.

Tests.—There is at present no means of detecting the existence of tuberculosis in a fowl until the affection has progressed sufficiently to produce lameness or emaciation. There is reason to believe that fowls may be diseased badly enough to make them a source of danger to other fowls, without suggesting by their appearance that they are affected. The tuberculin test so generally used for the detection of the disease in cattle does not give positive results when applied to tuberculous fowls.

Tuberculin is a liquid prepared from beef broth in which the tubercle

bacteria have been cultivated for several weeks. When injected under the skin of cattle affected with tuberculosis, it produces a rise of temperature usually about two degrees above normal. The test, in competent and honest hands, affords a ready means for detecting the disease when other means would fail.

Trials upon twenty-one fowls affected with the disease have not indicated that the test may be successfully applied to them.

The tests recorded in the first three tables were made with ordinary tuberculin, that made from a culture of the tubercle bacterium isolated from the disease in man. In view of the unsatisfactory results obtained, it was determined to repeat the work using some tuberculin prepared from a culture of the tubercle bacterium isolated from a diseased fowl. Dr. V. A. Moore, of Cornell University, kindly prepared some of this avian tuberculin for the tests recorded in Table IV.

TABLE I.

Tuberculin Tests upon Fowls. Ordinary Tuberculin.

	No. 64.	No. 65.	No. 66.	No. 68.	No. 70.	No. 77.
Aug. 12, 9:00 P. M.	40.9°	41.8°	41.1°	40.6°	40.2°	40.7°
13, 9:30 A. M.	41.6	41.6	41.2	41.3	40.9	41.4
9:30 A. M. Injected 1 c.c.						
1:30 P. M.	42.0	41.7	41.6	41.4	41.9	40.0
3:00 P. M.	41.9	41.9	42.2	41.7	41.1	40.6
4:00 P. M.	41.4	42.2	42.4	41.3	41.8	40.3
5:00 P. M.	42.0	41.8	42.2	42.0	41.7	40.3
6:00 P. M.	42.1	42.1	42.2	41.8	41.6	40.1
Aug. 14, 10:00 A. M.	41.8	41.7	41.0	42.0	41.6	41.0
	+*	+	+	+	+	+

TABLE II.

Tuberculin Tests upon Fowls. Ordinary Tuberculin.

	No. 36.	No. 52.
Aug. 9, 11:00 A. M.	42.0°	41.4°
12:00 M.	42.1	41.9
1:00 P. M.	41.9	41.7
3:00 P. M.	42.2	41.7
Aug. 10, 8:00 A. M.	41.8	41.6
8:00 A. M. Injected .5 c.c.		
1:00 P. M.	42.4	42.0
2:30 P. M.	43.1	41.8
3:00 P. M.	42.7	41.8
	−*	+

*The presence or absence of lesions of tuberculosis as noted at post-mortem examinations is indicated by + or −.

TABLE III.

Tuberculin Tests upon Fowls. Ordinary Tuberculin.

	No. 37.	No. 47.	No. 49.
Aug. 8, 10:00 A. M.	41.8°	42.4°	42.9°
10:00 A. M. Injected .5 c.c.			
11:00 A. M.	42.2	42.4	41.9
1:00 P. M.	42.1	42.7	42.1
2:00 P. M.	42.3	42.6	42.2
3:00 P. M.	42.2	42.7	42.8
4:00 P. M.	42.6	42.7	43.3
5:00 P. M.	42.6	42.2	43.6
6:00 P. M.	42.2	42.1	42.7
8:00 P. M.	41.8	41.7	41.8
10:00 P. M.	42.1	42.3	42.7
Aug. 9, 11:00 A. M.	42.1	41.9	41.9
	−*	+	+

TABLE IV.

Tuberculin Tests upon Fowls. Ordinary Tuberculin.

	No. 59.	No. 61.	No. 62.	No. 63.
Aug. 7, 10:00 P. M.	41.1°	41.4°	39.9°	40.6°
8, 9:00 A. M. Injected	.6 c.c.	.6 c.c.	.4 c.c.	.2 c.c.
9:00 A. M.	42.3	41.7	41.6	41.0
11:00 A. M.	42.7	42.0	41.3	40.9
1:00 P. M.	42.0	41.8	41.3	41.2
3:00 P. M.	41.7	42.1	41.6	41.0
5:00 P. M.	41.7	41.7	41.4	40.9
Aug. 9, 11:00 A. M.	41.6	42.2	41.1	40.9
12:00 M.	41.7	41.9	41.4	----
1:00 P. M.	41.6	41.9	41.4	----
3:00 P. M.	41.8	41.9	41.9	-
Aug. 10, 8:00 A. M. Injected 1 c.c.	42.0	42.2	41.7	---
1:00 P. M.	42.0	42.3	41.9	----
2:00 P. M.	----	42.4	----	----
3:00 P. M.	42.2	42.3	41.9	----
4:00 P. M.	42.3	42.4	42.0	----
	−*	+	+	−

TABLE V.

Tuberculin Tests upon Fowls. Ordinary Tuberculin.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 75.
3:00 P. M.	42.0°	42.7°	42.3°	42.3°	42.3°
5:00 P. M.	41.3	42.4	41.3	41.9	41.9
7:00 P. M.	41.3	41.9	41.3	41.6	41.6
9:00 P. M.	41.4	42.1	41.4	41.9	41.8
10:00 P. M.	41.7	42.3	41.6	41.8	41.4
10:00 P. M. Injected .5 c.c.					
7:00 A. M.	41.9	42.4	42.4	42.4	42.4
9:00 A. M.	42.0	42.4	41.1	42.0	42.4
11:00 A. M.	41.8	42.2	41.2	41.8	42.3
1:00 P. M.	41.6	42.3	41.2	41.9	42.4
3:00 P. M.	41.9	41.7	41.6	41.9	42.3
	−*	−	+	(?)	−

*The presence or absence of lesions of tuberculosis as noted at post-mortem examinations is indicated by + or −.

TABLE VI.

Tuberculin Tests upon Fowls.

0.5 c.c. of avian tuberculin injected at 7 A. M. March 18, in each case.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Mar. 17, 10:30 A.M.	42.0°	42.6°	42.4°	42.2°	42.8°	41.9°	43.1°	42.3°	42.0°	41.4°	42.6°	41.8°	41.3°
12:30 P.M.	41.6	42.4	42.2	42.1	42.7	41.6	42.3	42.0	42.1	41.8	42.7	42.0	41.6
2:30 P.M.	42.0	42.2	42.2	41.8	42.3	41.4	42.8	42.1	---	41.6	42.2	41.8	41.8
4:30 P.M.	41.7	42.1	42.1	41.7	42.4	42.2	42.6	41.9	42.3	41.7	42.1	41.8	41.9
Mar. 18, 10:00 A.M.	42.1	42.3	42.2	41.9	42.4	42.0	42.6	41.9	42.1	41.4	42.3	41.7	41.3
11:00 A.M.	41.8	42.2	42.7	41.7	42.0	42.1	42.4	42.1	41.1	41.1	42.1	42.2	41.3
12:00 M.	41.6	42.0	42.6	42.2	42.0	41.7	42.3	42.2	42.2	40.9	41.7	43.7	41.4
1:00 P.M.	42.6	42.0	42.2	42.2	42.1	41.8	42.4	42.2	42.3	40.6	42.0	42.2	41.4
2:00 P.M.	41.9	42.1	42.4	41.7	42.0	41.7	42.4	42.0	42.0	40.3	42.2	41.9	41.4
3:00 A.M.	42.0	42.3	42.2	41.7	42.1	41.6	42.7	42.1	42.2	41.9	42.1	41.8	41.4
4:00 P.M.	41.4	42.1	42.3	41.3	42.1	41.0	42.6	41.9	41.9	39.4	41.9	41.6	41.6
5:00 P.M.	41.9	42.2	42.4	41.6	42.1	41.3	42.6	41.9	41.6	39.6	41.9	42.1	40.7
7:00 P.M.	41.3	41.9	42.4	41.4	41.9	41.1	42.3	41.7	41.7	39.4	41.1	40.6	40.3
	+*	−	+	+	+	−	−	−	−	+	+	+	+

*The presence or absence of lesions of tuberculosis as noted at post-mortem examinations is indicated by + or −.

The figures do not reveal a marked rise in temperature in tuberculous fowls after the injection of tuberculin. In many cases a slight rise is noted, but this may be attributed to the fact that the temperature of a fowl is higher during the middle of the day than at other times.

Even should the tuberculin test prove applicable to fowls, its usefulness would be limited, on account of the impossibility of applying it to a large number of them, as would be necessary on a large poultry ranch. Nevertheless, the test would be very useful in experiments to determine the possibility of the transmission of tuberculosis of man or cattle to fowls.

Control of the Disease.—There is no apparent way of recognizing all the tuberculous fowls in a flock so that they may be removed. Therefore, all the individuals in an infected flock must be regarded as dangerous to those free from the disease, and must be kept separated from them. To counterbalance this difficulty the problem of controlling tuberculosis in fowls has some encouraging features. The useful life of the hen is generally regarded as ended at three years of age. This fact obviates the necessity for the quarantine of infected individuals for many years, as is done with cattle.

The further spread of the disease through a flock where it already exists may be impeded by sanitary measures. Fowls suspected as having tuberculosis should be slaughtered promptly. The roosting-houses should be cleaned and disinfected as often as practicable. It should be remembered that cases which can not be detected are constantly spreading the germs of the disease about the houses, and in

consequence the effect of one spraying with a disinfectant is of short duration.

There are upon the market in California several disinfectants that are suitable for the purpose. Among these are "Zenoleum," "Lincoln Dip," and "Chloro-Naptholeum." Tests made by Lewis and Nicholson* show that these disinfectants are effectual when used in a two per cent solution (one gallon of disinfectant to forty-nine gallons of water).

There is good reason to believe that young stock may be kept free from tuberculosis by completely isolating them from hens among which the disease exists, or from land recently occupied by such fowls. The conditions under which the poultry business is carried on in California do not seem to offer serious objection to such practice. In the establishments where the fowls are kept in corrals this condition may be easily maintained. Upon the larger ranches where the fowls are not restrained, and roam at will in the vicinity of their respective colonies, the quarantine may not be so strictly enforced. Much danger may be avoided by locating the colonies of pullets as far as possible from the old stock, or from land recently contaminated by them. The complete isolation of the young from contact with the diseased is a precaution unquestionably successful in preventing the spread of tuberculosis in man and cattle; and there seems to be no reason why the principle should fail in the case of poultry. The experiment is being tried upon a number of ranches with pullets hatched during the present season.

Transfer of laying hens appears to be an important cause of the spread of the disease to ranches where it has not hitherto existed. On sanitary grounds the purchase of grown stock is condemned as dangerous; for there is a strong probability that the purchaser will receive fowls from a flock that has had a bad record of deaths from tuberculosis or other causes. Enough examples of such cases have been observed to warrant wording an emphatic warning. *Those embarking in the poultry business should aim to raise their own hens.*

Relation to Tuberculosis in Man and Cattle.—The subject of the relationship between tuberculosis in man or cattle and the disease in fowls is full of interest. Tuberculosis in cattle is prevalent in the same district in which the disease occurs in fowls, and examples of tuberculosis in both cattle and fowls on the same ranch have been observed. Attempts by Gilbert and Roger† to transmit the disease from

*Lewis and Nicholson: Disinfecting Power of Coal-Tar Dips. Oklahoma Agricultural Experiment Station, Bulletin No. 62, 1904.

† Gilbert and Roger, in collaboration with Cadiot: Contribution à l'étude de la tuberculose avaire. Etudes de Pathologie et de Clinique.

man or cattle to fowls have usually failed. Successful transmission of the disease to fowls from man or cattle has rarely been accomplished. Cattle are found upon but a very small percentage of the poultry ranches, and in consequence the question of the possible transmission of the disease from cattle to fowls is relatively unimportant.

Tuberculosis in man is not noticeably prevalent in the community where most cases of the disease in fowls have been found, for it is not frequented by consumptives in search of favorable climatic conditions. The possibility of the transmission of tuberculosis from poultry to man is a matter concerning which it is exceedingly difficult to collect evidence. The fact that chickens, when eaten, are always well cooked indicates that there is practically no danger from that source. It has not been proven that tuberculosis is transmitted through the egg, and furthermore, most eggs are well cooked when served. It does not appear, therefore, that tuberculosis in fowls is a matter that very intimately concerns public health.

SUMMARY OF SUGGESTIONS FOR THE CONTROL OF TUBERCULOSIS IN FOWLS.

Kill all fowls showing symptoms of the disease.

Separate the flock of affected fowls as thoroughly as possible from the healthy ones.

Spray the roosting-houses with a disinfectant as frequently as is consistent with the expense and value of the fowls.

Take care to keep the young pullets away from the diseased stock or from land recently occupied by the latter.

CALIFORNIA POULTRY EXPERIMENT STATION.

The importance of the poultry industry in California has occasioned a demand for the investigation of the problems of poultry management. In response, the Legislature of 1903 appropriated five thousand dollars ($5,000) to be expended by the Regents of the University of California for this purpose, in the manner indicated in the following quotations from the Act:

SECTION 1. There is hereby established in the county of Sonoma, at or near the city of Petaluma, a poultry experiment station, to be known as the California Poultry Experiment Station.

SEC. 2. The purpose of said station shall be the study of the diseases of poultry to ascertain the causes of such diseases, and to recommend treatment for the prevention and cure of the same; to ascertain the relative value of the poultry foods for the production of flesh, fat, eggs, and feathers; to recommend methods of sanitation, and to conduct investigations for the purpose of securing results conducive to the promotion of the poultry interests of the State. This Act shall be liberally construed to the end that the station hereby established may at all times contribute to the technical and general knowledge of the public upon the subject of poultry husbandry.

SEC. 3. The said station shall be under the supervision of the Director of the Agricultural Experiment Stations of the State of California, who shall, from time to time, cause to be issued bulletins of information regarding the care of poultry.

The experimental work on poultry is being carried on by members of the regular staff of the Agricultural Experiment Station.

The following publications on poultry topics are available for distribution, and may be had upon application to the Director of the Agricultural Experiment Station at Berkeley:

Bulletin No. 156. Fowl Cholera.

Bulletin No. 161. Tuberculosis in Fowls.

REPORTS AND BULLETINS AVAILABLE FOR DISTRIBUTION.

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9. Asparagus Rust.
10. Reading Course in Economic Entomology.
11. Fumigation Practice.
12. Silk Culture.

Copies may be had by application to the Director of the Experiment Station, Berkeley, California.